

American Fern Journal

Vol. 7

JULY-SEPTEMBER, 1917

No. 3

Experiences with a Fern Garden—I.

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In 1911 I started a fern garden. The space used for this purpose is only a small bed, twenty-five feet long and about four and one-half feet wide. I built a small rock pile at one end and a larger one, shaped partly like a horse-shoe, in the middle. The bed consisted of good but rather heavy garden soil and after trying to grow ferns I found that most species did not thrive well in it; so in August, 1913, I dug the ground out to the depth of four inches, as close to the planted ferns as possible without jeopardizing their growth, and filled in the excavations with leaf mold and woods ground mixed with some fine sand, decaying wood, and a small quantity of crushed limestone. A marked increase in growth and vigor was the result. The small garden slugs proved themselves a source of annoyance by devouring the young crosiers, particularly those of the more tender species, as soon as they appeared above the ground. The grape ferns, rattlesnake ferns, walking leaf, and adder's tongue suffered especially in this way. I finally overcame this difficulty by covering the surface of the bed with fine sand, over which the slugs were unable to drag their slimy bodies. The bed is partially shaded by a cherry tree and a pear tree and the soil is only moderately moist. At the sunnier end of the bed I planted a few sweetbriers to furnish additional shade. A covering of leaves in the fall with a fresh coating of sand in the spring keeps the bed in good condition.

[No. 2 of the JOURNAL (7: 33-66, Plates 2 and 3) was issued May 5, 1917.]

Occasionally, during drought, it becomes necessary to supply some species with water at intervals of a few days to keep them in healthy growth. While all species appreciate this treatment, it may become specially necessary for the cinnamon fern, walking leaf, marsh fern, and perhaps a few others.

Since it takes two or three years for ferns to become fully established and to attain their natural thrifty appearance, no record of growth was kept in 1912. The date when they began growing in spring was recorded when the crosiers had appeared above ground sufficiently to expose the entire coiled portion.

The shield ferns, in general, are easy of cultivation. In July, 1911, I planted three marginal shield ferns on the fern bed and in September of the same year I set ten of these common ferns in a row along a side porch. All of them grew well. In the spring of 1913, individuals started growing from April 23 to April 30. The spring of 1913 was perhaps slightly earlier than usual, but in 1914 spring came tardily and the marginals began growing from May 4 to May 12. The row along the porch starts close against the wall of a cellar containing the heating furnace and extends outward seven feet. In 1915, an average spring, the ferns of this row began growing in order of their distance from the warm cellar wall, from April 23 to May 9. By June 21, some of the spores were ripe. Practically all of them were ripe on the first fertile fronds by the end of June. While the fruit dots, or sori, of the marginals seem purple and give a beautiful appearance to the under side of the frond, the indusium is really light violet and the characteristic color is imparted by the rich purple or brown-purple spore cases, or sporangia, underneath. After the spores are scattered, the indusia turn light brown. On the later fertile fronds developing in August and September, the fruit dots are frequently not so richly

colored. Partly fertile fronds are occasionally found among the sterile fronds appearing in July and August.

Two spinulose shield ferns of the regular type and three of the variety *intermedium* were set in the fern bed in July, 1911, and one apparently of the variety *dilatatum* was planted in August, 1914. While all of them grew nicely, they seem to require a richer soil than the marginals to reach the same degree of development. They began growing during the last week in April with the exception of one vigorous plant, which started to grow on April 19, and one old one, which did not show any activity until May 4. The first fronds are mostly fertile. Occasional fertile or partly fertile fronds appear with the sterile fronds in June and July. By June 7, some of the spores were ripe, and by the 20th of June, light brown fruit patches were all that remained to mark the places that had been filled to overflowing with the beautiful black or black-purple spore cases. The true spinulose shield fern is found in this locality only occasionally, the variety *intermedium* is fairly common, but the variety *dilatatum*, or at least a form that resembles it, is decidedly rare.

From a muddy spot near the foot of the mountain I brought a crested fern and planted it in my fern garden in July, 1912. Although I could not provide it with a swampy home, it grew and thrived in its new situation for a few years until some vigorous lady ferns encroached upon the space allotted to it and gradually crowded it out. In October, 1914, I transferred another crested fern, from a rather wet meadow border, to my fern bed; and this one is multiplying and flourishing in a very satisfactory manner, its erect fertile fronds, with their horizontal pinnae, marking it with characteristic distinctness. The crested fern began to grow from April 25 to May 2, although some of the fronds on the oldest part of the largest fern did not appear until May 10.

The pale tan to violet-tan fruit dots were coloring well by June 9, and the violet-brown to dark purple-brown spore cases ripened on the several fronds from June 14 to June 30. In the crested fern, the fertile fronds are decidedly the first to appear, in spite of the fact that a few small sterile fronds occasionally appear with or even before the fertile ones; and the actual growth of sterile fronds does not begin until late in June or in July. Some of these sterile fronds are occasionally partly fertile.

Goldie's shield fern is very rare in this region, but I was fortunate in finding a fine colony in a mountain ravine and in August, 1911, I planted two of these ferns in a recess at the base of the rock pile in my fern garden. They grew well in their new home, the young ferns appearing from April 26 to May 4. By about the 10th of June the indusia covering the flat sori are pale violet, later changing to straw color, and during the last week in June the spore cases have ripened and are light brown to rather dark brown in color. The new fronds appearing during the latter half of June and in July are mostly sterile, but some of them are fertile on the upper portion.

The New York fern does not flourish so well as it does in the habitat from which it was transplanted. In July, 1911, I planted two of these ferns, one on the fern bed and one close to the wall of the house. By 1913 the plant on the fern bed had died and in August, 1914, I planted another one in its place. Although both of the plants are gradually establishing themselves, sending up each succeeding spring, about April 28, an increasing number of slender crosiers, the fronds have so far failed to attain the length to which they grow in the wild state. The first fronds, as a rule, are sterile, and usually a large percentage of the fronds grown during the season do not fruit. The fertile fronds begin to appear about the third week in June and the shining dark brown to nearly black sporangia begin to ripen

during the last week in July, the majority not ripening until the middle of August. Some fronds appear in August and these are sterile or only partly fertile.

In September, 1911, I transferred a marsh fern from a small marsh, where its rootstocks were buried in mud, to my fern bed; and in spite of the drier situation, it flourishes and multiplies, forming a close stand and spreading outward on all sides. In 1915, a few crosiers showed their green heads as early as March 27, but the sterile fronds usually begin growing about April 23, while the narrower fertile ones appear during the latter part of July and early in August, the dark brown or black spore cases ripening during the latter half of August.

The male fern is not found in this part of the country, so I bought a plant for my fern garden, in May, 1911; and it grows beautifully. Several young plants formed on the side of the original rootstock. I transplanted one of these in September, 1914, and I now have two splendid clumps of fronds. The younger fronds around the outside of the plant begin to grow about April 24, but those on the oldest part of the original rootstock usually do not appear until the first week in May, but in 1913 they actually delayed their coming until May 20 and the first ones of these were mostly stunted and poorly formed. Probably as a result of this poor growth, the fern fruited sparingly and the spores did not ripen till the middle of July; but in following years the fruit ripened during the second week in June, the violet-purple sori with their blackish brown sporangia presenting a beautiful appearance, looking like two rows of ornaments and closely resembling the fruit dots of the marginal shield fern in color, but not in position. The first fronds are mostly fertile, but fertile and sterile fronds, some of them only partly fertile, continue to appear late in June and in July. The indusia are pale yellow before the ripening stage begins.

The cinnamon fern, interrupted fern, and royal fern although frequenters of moist situations, continue to grow well in my fern garden. The fronds, however, fail to grow to the length which they attain in the wild state; and the cinnamon fern seems to suffer most in this respect. Three cinnamon ferns, two large plants and a small one, found a home in my fern garden in May, 1912. During the following years the older plants started their spring growth, the fertile fronds coming first, from April 21 to May 1. The sterile fronds appeared a week to ten days later. The fertile fronds are surrounded by the sterile ones, but a careful investigation will show that the fertile fronds actually arise from the outer circle while the sterile fronds, by strongly curving outward at their bases from the central part of the plant, appear to arise around the outside. The spore cases, at first light cinnamon, but soon turning cinnamon-brown, ripened from May 20 to May 25, all the spores had fallen by the beginning of June, and within a few days, by the end of the first week in June, the fertile fronds began to wither, soon bending or curving over in humble recognition of duty well performed; but some traces of them could still be found late in August.

In July, 1911, I planted two interrupted ferns on the bed and one along the wall of a side porch. Those on the fern bed began growing in spring from April 15 to April 21, but the one along the porch, standing in the natural soil and in a more exposed situation, usually came about a week later. By May 15 or 20, the cinnamon-brown sporangia were ripe and all the spores were shed within a week. The fruiting pinnae at once began to wither, but remained hanging, limp and brown, till September or later. As in the cinnamon fern, the first fronds are fertile and the sterile ones come about a week later. Each year some, and one year nearly all, of the fertile fronds of the plant at the porch have no sterile

pinnae, or only a few stunted ones, beyond the fertile pinnae. This condition apparently is produced by injury caused by strong winds whipping the tender young plants against the porch wall; but one year one of the fronds on the fern bed had no sterile pinnae above the fertile ones and only one stunted one below.

I planted two royal ferns in the fern bed in August, 1913, and in each of the three following years one began growing about April 21 and the other about April 26. Sterile and fertile fronds appear at the same time, some sterile fronds coming as late as July 15. The sterile parts of the fronds are colored light salmon or light purplish cinnamon when unfolding and the fertile portion is light green, sometimes tinged with yellowish. The mature fruiting part of the frond is dark cinnamon-brown and the dark green sporangia have ripened about May 25 and all have fallen by June 1, the fruiting portion remaining till late in July.

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(To be continued)

Notes on Hippochaete¹

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HIPPOCHAETE LAEVIGATA.

In a friendly criticism of Standley's Ferns of Greene Co., Mo., Mr. B. F. Bush, in the AMERICAN FERN JOURNAL for October-December, 1916, adopts the name *Equisetum Kansanum* Schaffner for the smooth annual-stemmed species that for many years has passed for *Equisetum laevigatum* Braun, transferring the latter name to the perennial plant that was later described as *Equisetum hyemale* var. *intermedium* by A. A. Eaton,

¹ In Mem. N. Y. Bot. Gard. 6: 461 ff., Mr. Farwell gives his reasons for separating the scouring-rushes from the true horse-tails as a separate genus under the name of *Hippochaete*.—Ed.